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SYMPOSIUM ON CHILD GROWTH AN

Over the past 20 years all groups working with children have been giving increasing attention to their growth and development. In the field of pediatrics this subject has become recognized as the special science on which medical care and health supervision appropriate to the age of the child is based. Professional workers in other fields of child care are also manifesting increasing interest in the processes of growth and development because these processes are so intimately related to the problems of children's nutrition, education, and mental health. All the processes and stages of growth and development, the interrelationships and the differences between them that are met in different children must be understood if health services are to be of greatest benefit to the individual child and if unfavorable circumstances are to be recognized and dealt with. Interest in this movement was greatly stimulated by the 1930 White House Conference on Child Health and Protection, at which the whole subject of growth and development was explored more thoroughly than it had been previously. Several institutions were organized soon after that conference and have been following children as individuals from many points of view ever since. Hence, we know a good deal more about the subject than we did 20 years ago.

Harold C. Stuart, M. D.
Moderator of the Symposium

WHY BE INTERESTED IN CHILD GROWTH AND DEVELOPMENT?

ALFRED H. WASHBURN, M. D.

IN DISCUSSING child growth and development we all too frequently plunge into a presentation of height and weight curves; or we discuss intelligence scores and school achievement, or some other specific and limited aspect of child growth, without giving thought to the total problem. For most of us the goal can be simply stated. It is the better understanding of a given child—or, for that matter, of a given adult—who behaves as he does because of the experiences he has had during his whole span of growth and development.

Let us consider child growth and development not as occurring in a vacuum but progressing dynamically in a given human being, who is continuously reacting, adapting, and adjusting to all sorts of environmental factors, from conception on. We are, then, interested in whatever happens to this individual during growth.

The inevitable relationship between the growth of the child and the nature of the resulting adult represents the first and most obvious reason for the interest of the public-health worker in the topic of this symposium. But this is by no means the entire answer to our question, "Why be interested in growth and development?" At the first meeting of the Society for Research in Child Development, in 1934, its president, Dr. Robert S. Woodworth, gave a beautifully concise answer to our question. He said in part:

"The importance of child development as a field of research cannot be called in question. The physical vigor and mental health of the adult depend on the growth process of childhood and youth, as well as on the genetic constitution, which also in all logic comes within the scope of our society. The social characteristics of the adult population have to be formed in early life. But to think of the child as existing simply for the purpose of becoming an adult would be false teleology from the biological standpoint and bad social evaluation as well. The growing child and the maturing youth are not mere means to an end but are entitled to full recognition in their own right. At any rate the student of child development has his eye fixed on the developmental process itself as something supremely fascinating and worthy of investigation."

The progress of research in human growth since then has served to reemphasize continuously Dr. Woodworth's two main points. The study of growth is fascinating in itself whether one is considering the developing embryo, the baby's first year, or the adolescent boy's dramatic blossoming out into manhood.

AN EVELOPMENT

This symposium was presented at the seventy-eighth annual meeting of the American Public Health Association, and related organizations, at St. Louis, Mo. The session at which the symposium took place was a joint meeting of three sections of the Association — The Food and Nutrition Section, the Maternal and Child Health Section, and the School Health Section—and the American School Health Association. The material published here is condensed from the papers given at the symposium.

At the same time more and more evidence is accumulating to demonstrate the meaningfulness to the individual of the particular experiences that he has as he grows through infancy and the early childhood years. Thus, we may think of the health or wholeness of the young adult, his soundness as a good citizen of the world, as being dependent upon the success that he had during childhood in adapting his self, his own unique individuality, to his world. And further, we may think of the baby or child at any age being an individual already uniquely himself and deserving of our sympathetic understanding.

Individuals vary within the pattern

In this problem of understanding the growth and development of an individual person, whether he be infant, child, or adult, there are two quite simple concepts that need to be a continuous part of one's thinking. The first is that every healthy child's development progresses according to and within the limits of the general human pattern.

Even though this is obvious, yet it remains true that one of our important tasks in studying human growth is the clearer delineation of the human pattern. To be sure, we have a fairly reliable picture of the pattern of weight and height increase, as well as that of the changes in a good many other structures. We have also a somewhat less adequate picture of the pattern by which certain functions develop. But concerning the developmental patterns of many functions, both physiological and psychological, we are still relatively ignorant.

The second concept is concerned with the amount of variation between individuals within the uniformity of the general human pattern. Each individual is unique. Let me use a very homely illustration to bring out the fact of how completely we all accept this idea even though we may not always act in accord with it when dealing with children.

We will assume that you are to meet a friend at the railroad station. Even though there may be several hundred persons going and coming through the station you will have no difficulty knowing which one is your friend as soon as you see him. In fact, even though he may approach you from behind, when he speaks your name you will know who he is before you see him.

We do not always give sufficient thought to the fact that his internal structures, such as heart or lungs, are just as characteristically and uniquely his as are his eyes and nose or body build. So too his less obvious physiological and psychological functions are just as characteristic for him as are his walk, his voice, or the cheeriness of his greeting. Within the limits of the general human pattern there are almost endless individual variations.

I should like to carry these thoughts about differences between individuals a step further. It is not just a question of any two of us being of different stature, or having differently shaped noses, or presenting different degrees of efficiency in the functioning of our heart and circulatory or central nervous systems. As I have suggested above, each of us represents the end product — in both structure and functioning — of a long and continuous series of interactions that have taken place during growth and adaptation. Often striking individual variations are to be found in the pathways that we have traveled in reaching our present end point. Or, put in a slightly different way, the patterns revealed by charting out the growth of a given structure or the development of a given function may vary greatly from child to child.

Babies gain at different rates

A nice illustration of this in the realm of structural change may be seen in the weight curves of two selected babies during their first 12 months of life. Even though they start at the same birth weight and weigh the same at 12 months, yet the curves may be quite strikingly dissimilar. For example, the first may rise very steeply in the first 1 to 4 months and then, bending sharply, show very little gain in the last 3 to 4 months. In contrast to this the second may form a more symmetrical arc, with a less steep rise at first and a more rapid rise in the second half of the year. The difference in the timing of adolescence in different children is, of course, a classic and dramatic example of variation in the patterns by which growth progresses in different but equally healthy children.

I shall assume, without further elaboration, that we all accept the existence of endless variation within

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the limits of the human pattern of growth. I shall assume also that we accept the fact that the individual's own characteristic pattern can be described, studied, and ultimately understood only against the background of the whole range of the human pattern. That is, a given person is tall or has a high blood pressure only relative to all other persons. And if he is 8 feet tall or has a systolic blood pressure of 200 millimeters of mercury then he is outside of the range of the healthy human pattern. But even assuming acceptance of these basic concepts one may still ask what is their significance for those of us who are dealing with the health and welfare of growing children.

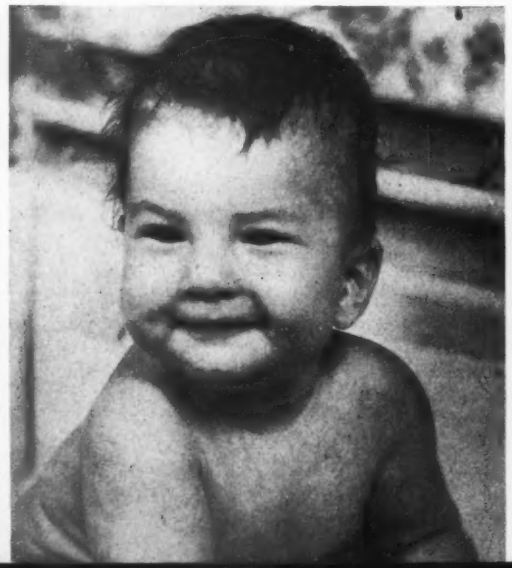
We need to know about the individual

During the last quarter of a century we have learned much about individual variations during growth. We have come to realize that these are meaningful for the individual—that the safeguarding of health involves some insight into the individual's unique pattern of growth—that the adequate diagnosing and treating of disease in a child necessitates knowing something of the nature of that child as well as of the peculiarities of the disease from which he happens to be suffering. For example, the difference in heart size between the smallest and largest hearts, which we have observed in healthy 8- to 10-year-old boys, is greater than the amount of increase one would usually see resulting from mild to moderately severe involvement with rheumatic fever. Or again, in boys undergoing a rapid adolescent growth spurt in both height and weight, the degree and rapidity of increase in heart size may closely approximate that seen in a preadolescent boy with progressive enlargement due to active rheumatic carditis. It is obvious that the possibility of correctly diagnosing pathologic enlargement of the heart implies an appreciation of these variations and growth patterns.

Although this is a fair illustration of the importance of studying human growth, yet it tells only part of the story. Public health is concerned with prevention as well as with the diagnosis and cure of disease. Prevention implies being able to look ahead—being able to predict with some measure of reliability. For example, preventing caries and defects in deciduous teeth necessitates a knowledge of the timing of the development of these teeth. And this, in turn, leads to concern with the adequacy of the mother's prenatal diet as well as with that of the baby after birth. Parenthetically one might add that our knowledge of such food requirements is still far from complete. Prevention of a number of so-called congenital anomalies of the heart, eyes, palate, or limbs of the expected baby similarly implies a knowledge of their pattern and varying speed of development at different stages. With this knowledge we can make every effort to protect the mother from infectious diseases and dietary deficiencies, particularly during the time of the baby's development in the uterus when they are most apt to distort the orderly progress of that part. We may accept, therefore, the thesis that the adequate diagnosis and prevention of disease is greatly dependent upon an understanding of human growth; but let us go a step further.

What leads us to study child development?

Most of us in such a group as this have accepted our responsibility for attempting more than the prevention of disease. To be sure, we must continue actively in this never-ending campaign against the diseases that plague mankind, but we must also learn how to educate people positively for health and happiness. We recognize that there is a difference between the mere absence of disease and the presence of robust good health. We feel sure that robust good health and stable adaptation to our environment make us more valuable as well as more delightful citizens of a democracy. But, alas, we are not nearly so sure just how one becomes and remains a healthy and happy citizen. The desire for this knowledge serves as a powerful stimulus for studies of the growth and development of individual children, such as those in which some of us are now engaged. I wish it were possible to give a complete record of the growth and development of just one subject followed in the Child Research Council for 10 or 15 years, but it takes



the staff a whole morning to review one such record. Instead, I shall just suggest the kinds of questions raised by such studies.

Jane is now a young woman of 18 years. She was a relatively small baby, born of parents whose size was somewhat below the average for the population. Throughout her childhood her height remained in the lowest 10 percent of our group of healthy girls. Her weight was always well below the tenth percentile, and tended to lag behind the tenth percentile curve in its rate of increase. Her thinness and slow growth were a source of worry to her parents, to teachers, to visiting nurses, and to physicians.

And yet her health record shows that she had fewer illnesses than the average and that her recovery from illness was usually prompter than that of the average child. Moreover, her intellectual development and her degree of emotional maturity were well ahead of the average. She usually seemed to be a pleasant, happy, and active child. Today she is a charming, popular, and bright young college woman, healthy and well-adjusted to her environment.

Long-time studies help

What factors in her constitutional make-up or in her early development should have served to tell us that she was progressing satisfactorily toward a healthy, happy young adult life? How can we distinguish between the naturally small, slowly growing child and the one who is small or slow to develop because of dietary deficiency, chronic illness, emotional handicaps, or a combination of such causal factors? Answers to such questions can come only from long-time studies of individual human beings.

We need to study each child as a whole integrated organism. Changing structure and function in a given child are really inseparable. Thus we must study structure — its changes during growth, its use to the individual, and its variations in different children — in such a manner as to lead to maximum opportunity to relate the structure studied to the total behavior, to the individuality of the person.

Many factors are involved

For instance, the pattern of a given child's changing bone structure at adolescence is closely related to the change in the basal metabolic rate; to increased food intake; to the appearance of secondary sex characteristics; in girls, to the onset of the menses; and to various other physiological and psychological changes.

However, both the chronological age at which these events occur and the precise pattern, involving speed of progress and duration of these changes, will vary greatly in different children. Each child during health follows his own pathway at his own speed. Thus the safe interpretation of such findings as "bone age" or "basal metabolism" must depend upon some familiarity with the particular individual and his own characteristic mode of progress. I do not mean to imply that this is a simple matter, as my next illustration will show.

What of his home life?

Jim is a slender boy of 14 years, not yet adolescent. In infancy and early childhood it seemed as though he was almost never completely well. He was allergic to many substances, he had innumerable minor colds, and many attacks of more severe respiratory tract infections. His recovery from illness was often slow and far from satisfactory. His eating habits, particularly in the preschool years, were erratic, leading to uncertain food intake even though his parents and his doctor supposedly did their best to give him an adequate diet.

But there were other important factors at work throughout his infancy and early childhood. His mother, who appeared, superficially, to be doing everything possible for him, was actually hostile to him from early infancy. A careful and thoughtful study of his regime—partly in retrospect—led us to the conclusion that she was often severely punitive in carrying out treatment for his endless symptoms. Sometimes as many as 10 to 12 medications had been used in one illness of a week or 10 days. Not only was he overtreated in nearly every sickness, but he even had several quite unnecessary operations, urged by the mother and carried out by an obliging doctor with too little awareness of the possible

mother-child relationship.

At 14 years he is in somewhat better health, though far from robust, and overconscious of potential disease. He is a far from happy boy, poorly adjusted in his neighborhood and school.

One may well ask how much of his early illness was precipitated by his mother's hostility and his resulting lack of love or security. Could his present status have been foreseen by the time he was 4 or 5 years old? If so, what could have been done then? Was he already seriously injured, physically, physiologically, and psychologically before he reached school age? How early in the life span must we be applying that form of preventive medicine which seeks to foster and encourage a positive program for health? And, finally, how shall we teach doctors and nurses and nutritionists to be aware of these problems so that they may avoid the error that Jim's doctor made of assuming that the mother was simply overconscientious — an error that led to his being used as the mother's accomplice in punishing Jim?

The importance of the effect of the personality characteristics of both parents and child on the total functioning of the individual infant or child, in health as well as in disease, is now generally accepted. Although investigation into the development of these traits in the early years is difficult, yet we know that the first 5 to 6 years represent a most important period for study if we are to understand adequately the behavior of the school child, the adolescent, or the young adult. Thoughtful observation of the interplay between the baby and his environment, starting with the mother, may give valuable clues concerning the individual's basic traits, and their development or modification, as he attempts to adapt to his environment. In a play setting, whether it be dolls, or clay, or paints, or just free play, the preschool-age child often reveals much of himself—his fears, his loves, his anxieties, his aspirations, the concepts of his little world, and just as in the more purely physical aspects of growth, so here, too, we need less emphasis on the mere measurement of status at a given moment and more emphasis on what the child is becoming, as well as on the "how" and the "why" of the becoming. Furthermore, we need more awareness of and more concentration on the interrelatedness of changes in structure, in physiological functioning, and in the development of emotional and other aspects of personality.

As we continue our studies in the Child Research Council, we are following the same individuals through childhood into their adult lives. We have now a score of young adults and five second-generation babies. Year by year the kind of evidence I have been discussing becomes more convincing. Individual variations have meaning. The pattern by which each child progresses is unique; but it is orderly for that child, if growth is healthy. The child's own pattern holds meaning not only concerning what sort of child he is now, but also in regard to what sort of older child or adult he is in the process of becoming. There is, of course, equally convincing evidence that environmental influences—the nature of the setting within which growth is occurring—may alter the pattern to a greater or lesser extent in different children. More studies on more persons, carried on through more than one generation, are urgently needed in order to provide adequate knowledge in this field. The usefulness of such knowledge to public-health workers in the future cannot be questioned. In fact, an adequate program for promulgating positive health measures is dependent upon a better understanding of human growth and adaptation.

Reprints in about 6 weeks

A RESEARCH INSTITUTE ON CHILD GROWTH AND DEVELOPMENT REPORTS PROGRESS

LESTER W. SONTAG, M. D.

THE Fels Research Institute was set up to study "prenatal and postnatal environment." Heredity, although not mentioned, was, of course, to be dealt with. The Institute was organized with the idea that we would measure as many behavioral, physiological, growth, and environmental factors as we could, over as long a time as we could. The program was, therefore, to involve many fields of study — to be "interdisciplinary." We envisioned as the research product a better delineation of normal values for many characteristics, and a better understanding of the meaning of individual deviations. We also banked heavily, if somewhat naively, on being able to demonstrate, and then understand, the relationship between various physiological, growth, maturational, and behavioral characteristics. Our basic objectives have not changed over the years, but I hope that our scientific sophistication has. Certainly our approach to the problems and our methods of attack have been greatly modified.

Here are some of the things we have learned and the conclusions we have come to about the organi-

zation of our project, our mode of procedure, and the way we hope to accomplish our purposes.

1. We found that the empirical selection of the characteristics we intended to measure — the mere measurement of as many individual characteristics of children as possible — and continuing the measurements over a long period, failed to yield us very satisfying scientific returns.

2. Increasingly we found it necessary to plan the specific use of data before they were collected. Unless such planning was done, the data more often than not proved inadequate for any attempt to solve problems later posed.

3. We found that in the field of child development, as in most other fields of science, the formulation of hypotheses is an important factor in sharpening research planning and stimulating research effort.

4. Our staff has all come to realize increasingly that the emotional needs of workers devoted to long-term projects such as child-development research are of extreme importance in planning a program. Relatively few individuals with initiative and creative minds find it easy to work toward the long-term goals of longitudinal studies of child development without having the program so designed as to create for each of them a series of sub-end points. Such an organization of program permits each staff member to undertake a series of publications in a given field or area which enables him to build for himself a position of authority and reputation in that area. The advantages to the scientific fraternity of the publication of such research results as they are achieved seems obvious.

5. We find that it is profitable to consider longitudinal research not only in terms of the lifetime of an individual but also as a series of periods of his lifetime. In other words, for many problems, the individual's life may be best considered in terms of a series of periods, for example, from 2 to 10 years.

6. We have been increasingly impressed with the fact that although simultaneous descriptions of a child in various disciplinary categories is interesting and challenging, it is not in itself productive of research results that we can adequately communicate to others. Our work has therefore increasingly tended to become a synthesis of factors designed to enable us to understand various aspects of the individual, working from the simple to the complex.

7. As the quality of staff has risen from year to year, staff members require greater autonomy in expressing their research interests, with the result that the cohesiveness and interrelationship of the objectives of the program has decreased.

8. The occasional use of a group of abnormal individuals for the purpose of formulating hypotheses and understanding normal processes is desirable. Examples of the type of study in which this is done are the study of steroids in the urine of children with precocious sexual development and the study of physiological responses to stress in cases of acute anxiety neuroses.

The work of the Institute is divided into four departments: Physical growth, biochemistry, psychophysiology, and psychology.

Physical growth

At first the work in physical growth emphasized primarily skeletal growth, patterns of appearance of ossification centers, and factors influencing such patterns. In recent years, however, emphasis has been placed increasingly on differential distribution of soft tissue throughout the body, as measured by a series of X-ray sections. Points of inquiry for the soft-tissue study are growth differentials and sex differences. The over-all objective of this work is to develop a method of describing body type in terms of differentials of soft-tissue distribution. The evolution of such a method, which is well along in its progress, will greatly stimulate an interdisciplinary aspect of our program, since it will then be possible to investigate possible relationships between body type, physiological responses to stress, certain aspects of social adaptation, and perhaps biochemical or physiological function.

Biochemistry

Our biochemistry department is in a much earlier developmental stage than is our department of physical growth. This is not only because the biochemistry department has been established more recently, but also because there is less clarity of precedent as to what biochemical characteristics of the child offer greatest promise of explaining important aspects of his structure or function. As a result our biochemistry department is in an active exploratory phase. At the moment it has elected to study both gonadal and cortical steroids. It may spend 2 or 3 years in modification of techniques for fractionation of steroids. It will at the same time be producing normative curves of steroid excretion in boys and girls. It has investigated the consistency of day-by-day steroid excretion, so that if at a later date it wishes to attempt to relate steroid excretion to rate of maturation or growth or to autonomic response pattern, it will know the sampling validity of its data. The biochemistry department is also investigating the role of alkaline phosphatase in the blood of growing children, and the significance of individual differences in its blood level. It is just finishing a study of vitamin levels in the blood of children and the relationship of such levels to intake, as measured qualitatively. It is working with the blood enzyme glucuronidase.

Psychophysiology

Our psychophysiology work is of fairly recent origin. The over-all plan of this department is to measure individual stress responses of skin conductance, skin temperature,

blood pressure, heart rate, and blood flow. We should like to know how such responses differ; whether they are gene-determined; to what degree they change with day-by-day emotional stress; what maturational changes occur. We want to know their relationship to later psychosomatic disturbances, and whether they are predictive of such disturbances; in what way they are related to personality structure; and whether they have biochemical, growth, or structural correlates. By this time, these psychophysiological measures are rapidly becoming a useful tool. Actually at the present time they are being used in an interdisciplinary problem, along with the Rorschach test, in attempting to determine the relationship of autonomic instability to anxiety in children.

Psychology

Although our psychology department is still concerned with a variety of aspects of behavior, its work is focused primarily on two major areas. They are: Resolution of infantile dependent needs of children into adult ego needs; and the ways in which different constellations of environment, primarily parental environment, modify and distort that resolution. The areas of study are, therefore, the constellation of parent behavior and the methods developed by individuals for the gratification of residual dependent need, together with defenses against the anxiety caused by frustration of such need. Publications to date have been primarily on the subject of measurement of parent behavior and the descriptions of different constellations of such behavior.

In the field of fetal behavior, an area of investigation in which the institute contributed considerably in its early years, we have of late been relatively inactive.

I have been somewhat hesitant in reporting, in a symposium on child growth and development, the activities of a single institute. Since, however, the experiences of other investigators in developing a research philosophy and a mode of operation for research in child development are probably comparable, I have been perhaps giving a general idea of the work of similar organizations in this field.

Dr. Lester Warren Sontag is Director of the Fels Research Institute for the Study of Human Development, and he is a Fellow in Psychiatry at the University of Cincinnati Medical School Department of Psychiatry. Dr. Sontag initiated the program of the Fels Research Institute 22 years ago and has continued as its director through the period of its growth into the largest institution of its kind in the world. Dr. Sontag is President of the Society for Research in Child Development.

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UNFAVORABLE LIVING CONDITIONS MAY HOLD BACK CHILDREN'S GROWTH

A pediatrician needs to question the background of an undersized child

JULIAN D. BOYD, M. D.

MOST PEOPLE take a child's physique for granted. They believe that since size and body build are largely controlled by inheritance, little or nothing can be done after birth to change an individual's physique. The general public, and even many professional workers, accept the fact that there are small children and large children at any given age; and they may have no more concern for littleness or bigness except as it relates to a child's clothing, or the height of his desk, or other such practical matters. Oftentimes school authorities have been discouraged from having physical measurements made of children because the parents consider these measurements useless. If it is assumed that physique is inborn, why should anyone be greatly concerned about it?

For years, anthropometric studies have pointed to the fact that though growth in height and weight indeed depends upon genetic factors, it is also subject to modification by conditions of living. As a pediatrician interested in child growth from the point of view of promoting child health, I feel that the findings of these studies should be applied more

widely in appraising the health of children.

To supplement his own studies of child growth, which I shall refer to later, Dr. Howard V. Meredith has reviewed and correlated many sets of measurements that have been published by other students of anthropometry during the past two or three generations. He has examined the measurements of a number of comparable groups of children—measurements made decades apart; and he finds that with the passage of time the average stature and weight of groups of children of similar ancestry and economic status have increased significantly, and that the increase is not limited to one race, or one economic level, or one age period of childhood. [2, 3, 4, 5]

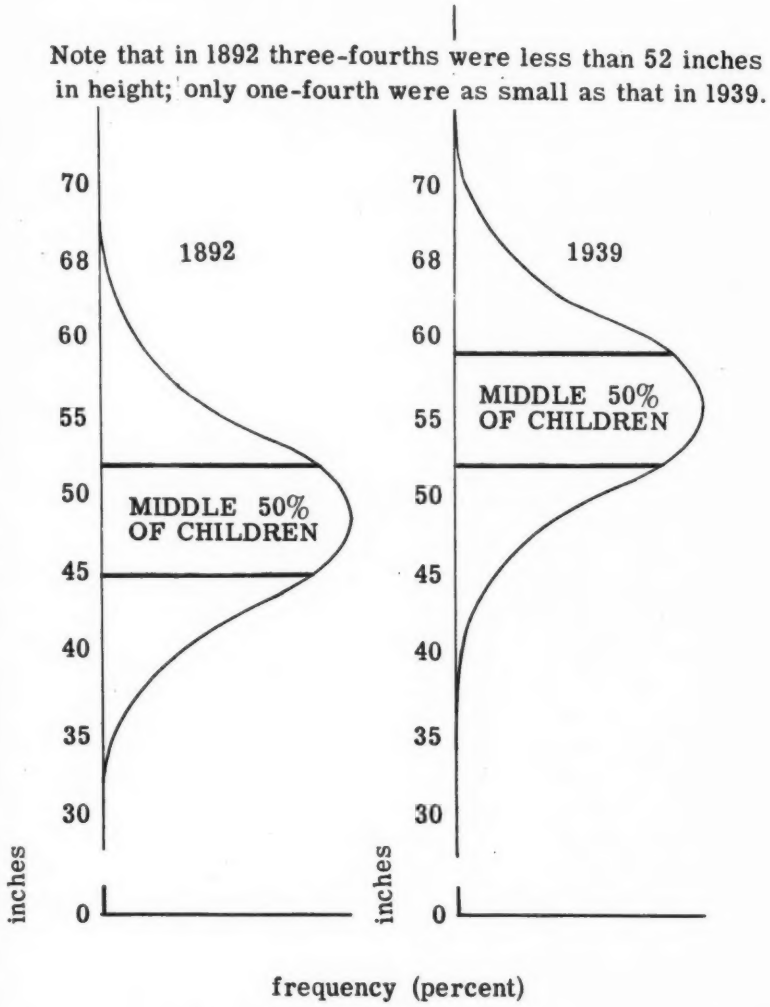
One of these comparisons is shown in the chart on this page, in which the average height of 832 10-year-old girls measured in Toronto, Canada, in 1892, is compared with that of a group of 4,468 10-year-old girls measured in the same city in 1939. [6] As the chart shows, the girls measured in 1939 were in general taller than those measured more than four decades earlier. The heights of the middle 50 percent of the girls measured in 1892 ranged from 45 to 52 inches. Among those measured four decades later, the height of the middle 50 percent ranged from 52 to 59 inches.

Another comparison appears in the table on page 58, which shows 6 to 9 percent greater height and 8 to 15 percent greater weight for 9-year-old boys measured in fairly recent years than for boys of the same age measured in the nineteenth century. The increased height and weight occurred in three groups of boys, all born in the United States: a group who were of North European ancestry and high economic status; another group, of Italian ancestry and low economic status; and a third, of Negro ancestry, who were unselected as to economic status. In some of these studies the number of children was rather small; nevertheless the differences that occurred with the passage of time were consistent with those found in the Toronto comparison and in a number of others reported in the literature.

These and other examples of the increases in height and weight noted by Meredith have taken place during a period that has been characterized by progressive lowering of the infant mortality rate, by lengthening of life expectancy, by decline in the incidence of many infectious diseases almost to the vanishing point, and by development and application of the modern science of nutrition.

Meredith's observations support the view that modern living conditions tend to promote growth in greater measure than did conditions prevalent two and three generations ago. His observations agree with

DIFFERENCES IN STATURE, 1892 AND 1938;
10-YEAR-OLD GIRLS IN TORONTO, CANADA



Based on figures collected by Meredith [6]. The 1892 figures are from Franz Boas: Growth of Toronto Children. In Report of Commissioner of Education, 1896–97, vol. 2, pp. 1541–1599. Washington. The 1939 figures are from A Height and Weight Survey of Toronto Elementary School Children 1939. Department of Trade and Commerce, Dominion Bureau of Statistics. Ottawa, 1942. 36 pp.

those of many other workers, whose studies indicate that both in this country and in diverse regions abroad, young adults nowadays are taller than were those of the past. This difference, he believes, points directly to the conclusion that more healthful living conditions are associated with greater size, within the limits of each child's heritage.

AVERAGE HEIGHTS AND WEIGHTS OF VARIOUS GROUPS OF 9-YEAR-OLD BOYS BORN IN THE UNITED STATES

From Meredith [3]

I Boys of North European ancestry and of high economic status

Year	Height (inches)	Weight (pounds)	Investigator
1938	53.5	69.5	Simmons and Todd [1]
1879	50.4	61.1	Bowditch [2]
Difference	3.1 (6.1%)	8.4 (13.7%)	

II Boys of Italian ancestry and of low economic status

Year	Height (inches)	Weight (pounds)	Investigator
1939	50.8	59.5	Matheny and Meredith [3]
1899	46.8	51.8	Hrdlicka [4]
Difference	4.0 (8.5%)	7.7 (14.8%)	

III Boys of Negro ancestry and of unselected economic status

Year	Height (inches)	Weight (pounds)	Investigator
1941	52.2	63.9	Lloyd-Jones [5]
1898	49.3	59.0	MacDonald [6]
Difference	2.9 (5.8%)	4.9 (8.3%)	

[1] Simmons, K., and Todd, T. W.: Growth of Well Children; analysis of stature and weight, 3 months to 13 years. Growth, vol. 2, pp. 93-134. 1938.
[2] Bowditch, H. P.: The Growth of Children; a supplementary investigation. In Tenth Annual Report of the State Board of Health of Massachusetts. 1879. pp. 35-62.
[3] Unpublished.
[4] Hrdlicka, A.: Anthropological Investigations on One Thousand White and Colored Children of Both Sexes, the Inmates of the New York Juvenile Asylum; with additional notes on 100 colored children of the New York Colored Orphan Asylum, Wyncoop, Hallenbeck, Crawford Co. New York, 1900.
[5] Lloyd-Jones, Orren: Race and Stature; a study of Los Angeles school children. Research Quarterly, vol. 12: 83-97. March 1941.
[6] MacDonald, Arthur: Experimental Study of Children, Including Anthropometrical and Psychosocial Measurements of Washington School Children. In Report of Commissioner of Education, 1897-98, vol. 1, pp. 985-1204. U. S. Department of the Interior, Bureau of Education, Washington.

Meredith's studies began a number of years ago, when, as part of the child-study program of the Iowa Child Welfare Research Station, he and his associates began a series of measurements of large numbers of Iowa City children — weighing and measuring each child at regular intervals from early infancy through adolescence. The children were chiefly from families of middle economic status, many of them from university circles.

The measurements obtained on these Iowa City children from birth to 6 years correspond almost exactly with measurements reported by Vickers and Stuart for children in Boston. [9] And for older children no great differences appear between the Iowa City and the Boston data. We must remember that in both places the children measured were for the most part from families in the middle-income range, and that among these families the requisites for comfortable living and for health protection are likely to be more readily available than among families in general.

Even among a presumably favored group of children, whose average size is larger than that of children in lower economic groups, we find various rates of gain and a wide range in heights and weights. How are we to explain such great differences among children of a relatively homogeneous group? Are we justified in assuming that the variations are accounted for by heredity alone? Probably not, for we know that even in high economic groups the living habits of families vary. Therefore it behooves the pediatrician who encounters a child who seems undersized or underweight to consider carefully whether that child's growth may have been retarded by unhealthful living practices.

An example of varying gains in stature at different ages is given in the chart on page 59. The chart on page 61 shows growth curves that illustrate that the growth of children of similar ancestry who are of the same height in early childhood may differ rather widely later.

Well-known examples of factors that interfere with a child's optimum growth are those that impair his nutrition — conditions that lead to insufficient intake of the needed foods or to poor digestion, assimilation, or utilization of what he eats. Of these factors, inadequate intake of the needed foods would be the one most suspect in a child whose measurements are below the average for his group, especially if he is otherwise normal and in apparent health.

How are we to pick out the child whose growth is retarded by factors in his living conditions? Surely this question is important to every worker in the field of health.

To estimate desirable growth levels

One step toward finding the answer to this question is to use a suitable standard for growth. In our clinical work in the pediatric department of the State University of Iowa we found that the usual standards of height and weight for age were too low for the children we observed, even for those who were ill. In these standards the range for any given age was so broad that it included the measure-

Dr. Julian D. Boyd is Professor of Pediatrics at the State University of Iowa. His publications have dealt with the management of diabetes mellitus in children, the prevention of tooth decay, and the promotion of health through dietary practices.

ments of almost any child of that age we might encounter. It seemed to us that we needed standards based on measurements of children living under favorable circumstances—that such standards would permit a better estimate of desirable growth levels than did those standards that were based on measurements of a diverse child population.

Looking for more representative standards by which to judge our local children, we turned to Meredith's Iowa City data, and planned charts to be used in comparing the measurements of an individual child with the standard for children of his age in this group. Separate charts were made for boys and for girls, each chart to cover one of three age periods: Birth to 1 year, birth to 6 years, and 5 to 18 years. All the charts were planned for recording height and weight; the charts for the period from birth to 1 year were planned also for recording head measurements.

For each age group of boys and of girls, I mapped out the central range, or zone of values, where measurements of two-thirds of the children in Meredith's series were found. One of these charts is reproduced on page 60. Similar charts have been constructed by Stuart and Meredith [8] and by Meredith [7], the latter including additional body measurements.

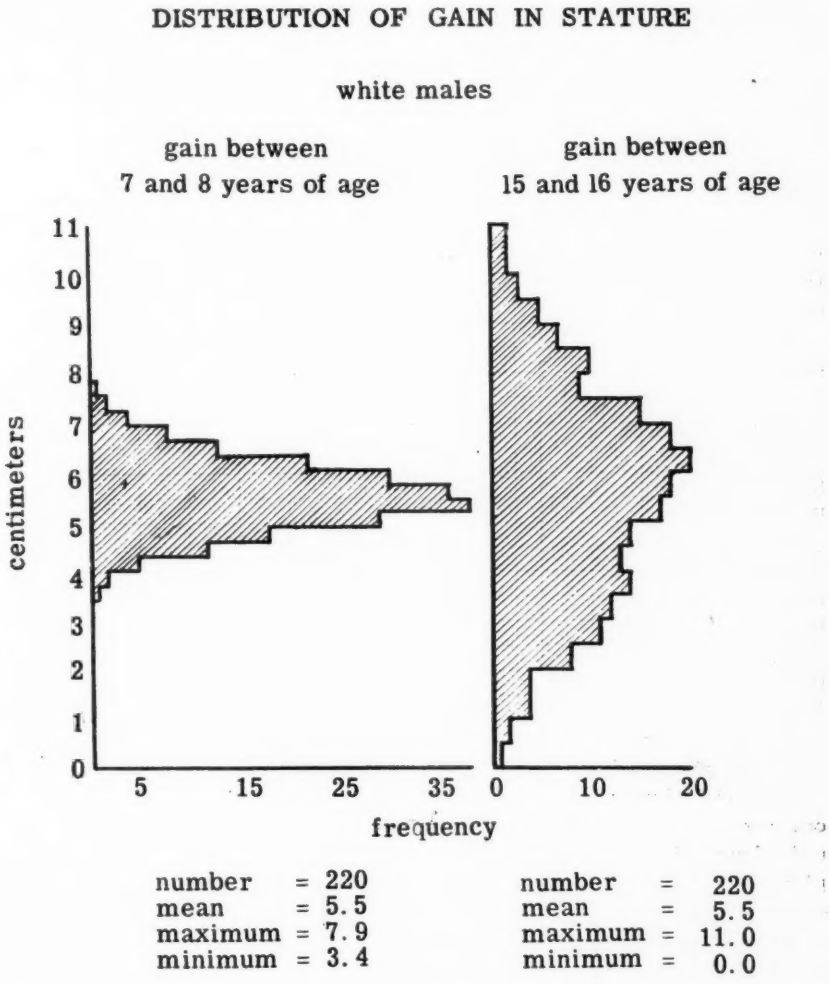
Each of these forms of chart has proved useful in comparing repeated measurements of an individual child with well-defined standards. The set of charts first described has been used routinely in our pediatric clinics for several years, both for well infants and children and for those with diseases.

The first step in our examination is for a staff member to take the child's measurements and to plot these measurements on the chart in terms of his chronologic age. Then, before taking the child's medical history, the physician compares the measurements with the corresponding standard measurements. He then directs his questions and his techniques of examination toward determining the significance and possible causes of any deviations.

He assumes that noteworthy deviations from the standard stem largely from environmental factors rather than from genetic ones; and he holds this assumption until careful questioning and examination procedures show that unfavorable environmental factors have not been operating. If adverse factors have been operating at an earlier time, he assumes that they are still operating, unless he finds that some marked break with previous patterns of living has taken place.

Since substandard dietary habits are so common among children, it is the rule rather than the exception for the physician who is examining an undersized or underweight child to hear a story of poor eating practices. [1] At that stage of the interview, the mother of such a child, having been brought skillfully to recognize that her child's eating practices have not been up to a desirable standard, usually is receptive to advice that will help her to improve not only her child's nutrition but other aspects of his health. Repeatedly, after such an interview, we have seen a child's later growth curve swing abruptly toward normal. Oftentimes disturbances in the child's health or behavior likewise have disappeared.

In summary: Growth is determined through the interplay of two



This chart, from Meredith [2], shows gain in stature of 220 boys between 7 and 8 years of age and of the same boys when between 15 and 16 years of age.

sets of forces — genetic factors and living habits. A child's genetic propensities determine his maximum capacity for development. The degree to which he is able to achieve the pattern set for him by his heredity will reflect the balance between favorable and unfavorable conditions in his environment from the time of conception through his whole period of growth.

Various factors can slow down growth

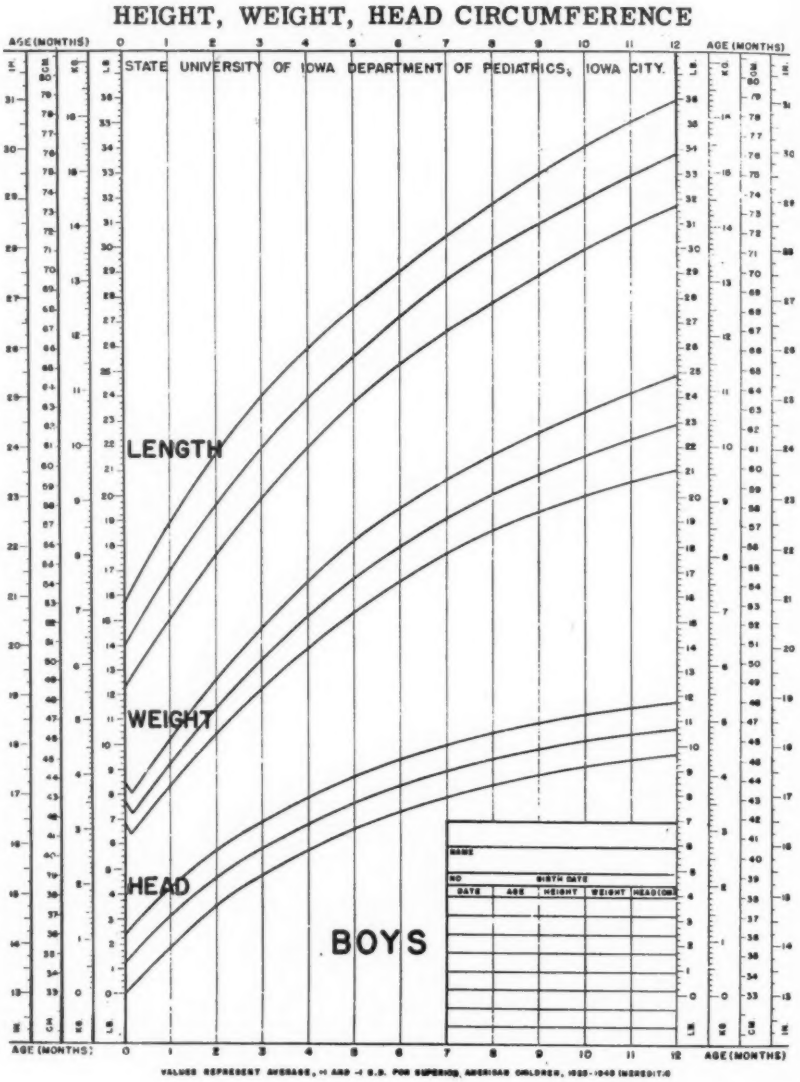
Recognizing that genetics plays a determining role in establishing the upper limits of growth and development, it is important for all of us to recognize also that faulty environmental circumstances often slow down a child's native growth rate and interfere with the full development of his physique, even though these circumstances may not make themselves apparent through other signs.

Unfavorable factors need not be spectacular to be effective; on the contrary, various common and apparently innocuous errors of environment can slow a child's rate of growth and can cause him to remain unnecessarily small when he reaches adulthood. Many years of clinical observations have led me to conclude that such slowing of growth is common among children, and that it frequently reflects poor diet practices. Therefore workers in the field of health should be trained properly to interpret growth standards and standards of nutrition.

It is well known that many accessory factors may lead to faulty nutrition; these include chronic physical or emotional fatigue, recurrent infections, emotional disturbances, and sometimes metabolic derangements. Persistent demands on a child that exceed his capacities, physical, mental, or emotional, may affect his growth unfavorably.

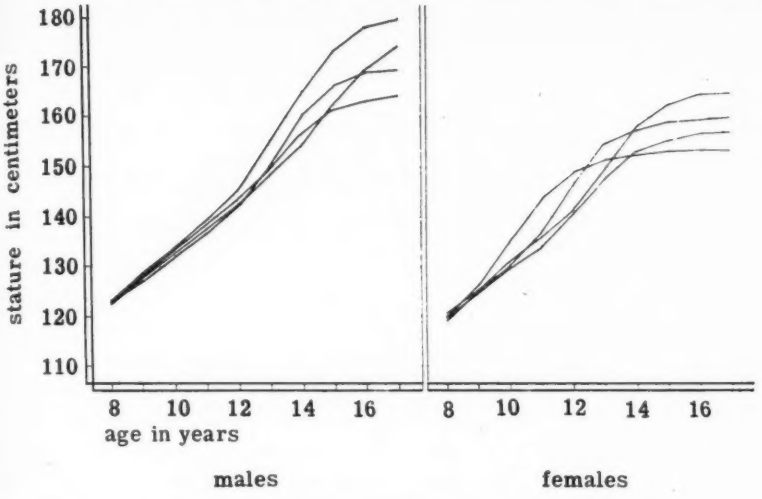
If a child is not small by inheritance, conditions that cause him to be undersized and underweight often are the forerunners of more obvious and more severe disturbances of his health.

Interest in causes of deviations from normal height and weight in a child, presented here from the standpoint of a pediatrician, is shared by the school doctor and nurse, the social worker, and every other professional worker who is concerned with the entire child. Each of us should work toward fulfilling the child's best possibilities and toward controlling factors that may lead to adverse conditions. Recognizing this common interest, I believe that continuing appraisal of physical growth should be a part of the regular examinations of the infant and the older child, whether or not disease is suspected. If a child's body length or weight is much below par according to a well-defined and appropriate standard, his pattern of living should be meticulously investigated to determine whether some fault in that pattern is responsible for the lag in the child's physical development.



This is one of the six charts—8½" by 11"—devised by the author for recording repeated measurements of children. For specimen copies write to Department of Pediatrics. State University of Iowa, Iowa City. The charts may be had in quantity, at $1 per pad of 100, from the Publications Department of the University.

INDIVIDUAL CURVES FOR FOUR BOYS AND FOUR GIRLS WHO WERE APPROXIMATELY IDENTICAL IN STATURE AT 8 YEARS OF AGE AND WIDELY DIVERGENT AT 17 YEARS



Growth curves from 8 to 17 years are given here for four boys and four girls, who were approximately of the same height at 8 years, but were widely divergent at 17. The chart is from Meredith [2], based on data from the Harvard Growth Study.

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Reprints in about 6 weeks

HOW CAN WE APPLY OUR KNOWLEDGE OF CHILD GROWTH AND DEVELOPMENT?

HAROLD C. STUART, M. D.

DR WASHBURN makes it clear that if a study of a child's growth and development is to be adequately broad, it must include consideration of his parents, his family, and his community, to provide background and understanding of the individual characteristics of his progress. Especially such studies must consider the mother's health during that important period of development extending from the baby's conception to his birth.

The studies that have been in progress at the Harvard School of Public Health during the past 20 years have devoted particular attention to the diet and nutritional state of the mother and the relation between these and the occurrences of pregnancy and the development of the fetus. Dr. Washburn and Dr. Sontag have been actively interested in maternal health problems from this point of view. It is clear that the need for knowledge of family background, and of the mother's health, and of family welfare in the community applies equally to child-health services, which confront the problems of growth and development in relation to health and individual fitness.

A feature of Dr. Washburn's paper is the emphasis he places on gaining an understanding of why a particular child grows and develops as he does, and not merely on how children in general grow, nor even on how this child grows. The marriage between the science of human ontogeny — the development of the child from conception to maturity— and the science of human ecology— the interrelationships between the individual and his environment, and the adaptations between them — is as essential to child-health services as to research. Public health essentially is concerned with the environment and with the adaptations of human beings to it, the points at which these adaptations frequently break down, and the control of the environmental factors that commonly cause such failures. The environment must be more strictly controlled for the child than for the adult. But the child's environment is continually changing—and should

be permitted to change — as his abilities to make successful adaptations improve through the natural processes of growth and development.

In Dr. Sontag's remarks he makes it clear that many difficulties must be overcome if one is to carry out the kinds of studies of the growth and development of children that we are considering. All sorts of problems are introduced by the duration of such projects: Maintaining continuing contacts with the children being studied; the inevitable changes in staff; the growth and consequent change in point of view of individual workers; the necessary alterations in plans consequent upon depressions and wars.

Dr. Sontag does not suggest that the whole story is nutrition or emotion or something else, but rather that all fields must be carefully considered, evaluated individually, and related one to the other. We expect each representative of a specific field to be particularly interested in his own subject; but for a group of specialists to work together effectively in the field of child development there must be great understanding on the part of all and capacity for leadership on the part of the director.

In Dr. Boyd's paper he brings out a number of problems that we all recognize as involved when one is trying to evaluate the growth and development of an individual child and to understand the significance of unusual findings. He has made it clear that it is difficult, if not impossible, on the basis of a single examination, to make any definite statements about the significance of the findings, whether they be that the child is small or large for his age; that his growth has been slow or rapid, or other special features. Without knowing the child's background, one can only hazard a guess as to the suitability or even normality of the findings. He brought out the fact, however, that by continuing to examine the child periodically, one can gradually develop a picture of the appropriate pattern of growth for that child.

I think Dr. Boyd will agree that when we find a deviation from expected progress and obtain a history of possibly significant events, we still are not able to say with any assurance that this deviation is due to a specific cause. No matter how thoroughly we have investigated a situation, we are usually uncertain whether the conditions found actually caused the deviation; and, if it is probable that they did, what is the relative importance of each condition.

In order to apply these principles to health services, therefore, we must be aware not only of deviations from expected progress when they occur, but also of the factors in the environment, past and present, that may have accounted for them. It then follows logically that we shall try to correct all the unfavorable conditions that we recognize. But we must have more than sketchy information about a child before we undertake to alter his situation, and we must have some way to change undesirable conditions or habits when they are discovered.

Studies are needed to show, among large groups of children, the frequency of specific kinds of unfavorable conditions, whether defects in care or environment, diseases, nutritional deficiencies, or emotional disturbances, and to obtain a clearer understanding of the frequency of their association with different deviations from normal progress. This kind of information would be useful in finding out and interpreting the probable cause of a marked deviation in a given case. It would be of great help if public-health agencies providing services to children were in a favorable position to collect such data, so as to contribute to the welfare of the children concerned and to add to the general pool of knowledge.

Several questions have been raised regarding longitudinal and comprehensive studies of children and their application in public-health practice. One question has to do with the use of body measurements in following the physical growth of children. It has been pointed out that few measurements, possibly only of height and weight, are needed to bring to the attention of the observer unusual features of a child's build or of his progress. These measurements may be readily obtained by anyone who has enough interest to want them, who takes the trouble to learn the rules that assure accuracy, and who has the patience to check and record the measurements accurately. In the past the principal trouble in the use of measurements has been that attention has centered on single observations of a child in relation to his peers. Since our interest is in growth, emphasis is now placed on the changes in successive measurements of the same child. It has long been common practice to take and record weights and heights of children, but these are frequently recorded without having any suitable means of interpretation. Appropriate practice today calls for plotting these measurements on charts, of which there are a number available (such as those Dr. Boyd has described), which permit interpretation of the child's progress in relation to his own past and to different patterns of growth encountered in various groups of children.

Another question concerns the effect of the many observations made on the children enrolled in long-time studies — upon their knowledge, habits, emotions, and so forth. It is generally agreed that these experiences affect children, as do all their other experiences, and that

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Dr. Stuart has been director of a study of child health and development at the Harvard School of Public Health during the past 20 years. In that study a group of children has been followed periodically from birth to maturity by representatives of different disciplines concerned with child development.

precautions must always be taken to make sure that these will be beneficial rather than otherwise. The staff of a study project is an important part of the child's environment, and hence the personality and the characteristics and the attitudes of the personnel to the children enrolled are of great importance. Everybody who participates directly in studies of this sort—and this is equally important for all who participate in health services for children — should be interested in people, be skillful in gaining their confidence, and have special competence in dealing with children.

After 20 years of experience in this field, I can recall several instances in which it was impossible to obtain useful information from the study point of view because of the emotional responses of either mother or child. When this has been recognized and satisfactory adjustment could not be made quickly, we have recommended that the child be withdrawn from the study. In the great majority of instances, however, we have recognized many ways in which the child and the family have profited from their associations with our research staff.

In the studies of health and development in progress at present at the Harvard School of Public Health, boys and girls are almost every week passing through their eighteenth-year comprehensive examination, which requires about three half-days and is the last routine examination scheduled. The expressions of appreciation, not only by the parents but by the children themselves, for the opportunities they have had with us, are most gratifying. This is not said in defense of such research, but rather to impress upon all workers in the field of child health that the experiences they provide can be beneficial beyond the limits of their specific purposes. It is said rather to call attention to the great need among all such workers for knowledge and understanding of children as individuals, and not merely of specific aspects of their health or development.

Reprints in about 6 weeks

IN THE NEWS

Foster parents need not pay income tax on money they receive from a child-placing agency to pay for a child's care. Also, the agency making such payments is not required to report them. This has recently been ruled by the Commissioner of Internal Revenue, in response to a request by the Acting Federal Security Administrator for an advisory opinion on the status of such payments. The ruling made it clear that the amount paid by the agency must not be greater than the amount spent on the child's care by the foster parents.

After a conference between representatives of the Children's Bureau, the Child Welfare League of America, and the Federal Security Agency's Office of General Counsel, the Acting Federal Security Administrator wrote a letter to the Commissioner of Internal Revenue, accompanied by a brief supporting the position that payments by child-placing agencies for foster care are trust funds for the child and not income to the foster parents.

In a letter dated October 5, 1951, informing the Acting Administrator of the new ruling, the Commissioner said:

"It is the opinion of this office that where the payment made by the child-placing agency is solely for reimbursement of expenses incurred by the foster parent in taking care of the child and is in an amount not in excess of such expenses, neither said expenditures nor the reimbursements therefor need be reflected in the Federal income-tax return of the foster parent and the child-placing agencies are not required to file annual information returns under section 147 (a) of the Internal Revenue Code with respect to said maintenance payments."

A cerebral-palsy institute will be held Jan. 21–Feb. 1, 1952, sponsored by the Coordinating Council for Cerebral Palsy in New York City. Further information from Miss Marguerite Abbott, Executive Director, 270 Park Ave., New York 17, N. Y.

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Jan. 4–5, 1952. American Group Therapy Association. Eighth annual conference. New York.

Jan. 17. Maternity Center Association. Thirty-fourth annual meeting. New York, N. Y.

Jan. 26–31. American Academy of Orthopaedic Surgeons. Ninteenth annual convention. Chicago, Ill.

Jan. 27–31. Third National Conference on UNESCO. New York.

Jan. 30–Feb. 2. American Association of Schools of Social Work. Thirty-third annual meeting. New York, N. Y.

New edition of Infant Care issued

Infant Care, which has been published as a guide for mothers and fathers ever since 1914, has recently been issued in its ninth edition.

We shall tell you more about is in our next issue.

For your bookshelf

(Continued from page 64)

icies should be reduced to a minimum. Development of national standards for juvenile services in police departments, as recommended by the Midcentury White House Conference, would be helpful in attaining coordination between agencies.

It is disappointing to note that in this good-sized report only two short paragraphs are devoted to the rights of children and of parents. These are mentioned in relation to the activities of the police. However, the comments on these would be equally applicable to an "authority-using bureau," the establishment of which is recommended by the committee. The role of the police in relation to detention of children is not discussed.

As a whole this report offers a thoughtful and thought-provoking evaluation of an important type of agency.

William H. Sheridan

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THE CHILD

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FOR YOUR BOOKSHELF

POLICE AND CHILDREN; a study of New York City's Juvenile Aid Bureau. By Alfred J. Kahn. Citizens' Committee on Children of New York City, Inc., 1407 Broadway, New York 18, N. Y. 1951. 83 pp. $1.

Most police departments in cities have special divisions for working with boys and girls who break the law or seem to be in danger of doing so. But we see few reports on the work of these divisions; and so this study of the Juvenile Aid Bureau of New York City's Police Department will be welcomed by all persons concerned with the welfare of children, especially those we label delinquent.

After discussing modern principles for dealing with juvenile delinquency and defining some police functions in this field, the report describes the Juvenile Aid Bureau. It tells how the Bureau developed, how it is organized, and how it operates. It classifies the children referred to it and the offenses for which they were referred. And it takes up the relations between the bureau and other community agencies.

The committee's recommendations for strengthening the city's program for helping children in trouble are next presented. Then come the comments of the Juvenile Aid Bureau on these recommendations, and the committee's reply to the bureau. The bureau and the committee agree on some of the recommendations, but disagree rather sharply on others; and considerable divergence appears on fundamental questions relating to the prevention and treatment of delinquency as well as to the functions of the law-enforcement agency.

There is growing recognition on the part of other agencies in communities of the fact that the law-enforcement agency has an important role to play in community programs for the protection of children and the prevention of delinquency. On the other hand, the law-enforcement agency must also recognize that it is only one of many agencies in the community concerned with children. If maximum effectiveness is to be achieved, differences of opinion affecting philosophy, objectives, and basic methods and pol-

(Continued on page 63)

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